

PLASTERER'S MANUAL

*for applying
portland cement stucco and plaster*

PORTLAND CEMENT ASSOCIATION

An Old Timer Speaks



John H. Donlin, editor of "The Plasterer."

"By one who has nothing but the welfare of our craft at heart, this earnest plea is made—find out what good stucco work really means—assure yourself that right materials are used in all coats to make permanent the beauty of the finish—take advantage of opportunities to learn how to create beautiful colored and textured effects—in short, *be a craftsman as well as a plasterer!*

"There is an appreciation of the beauty in colored and textured walls today that will greatly increase the scope of the plasterer's work if he will but realize his opportunity and equip himself to do such work.

"Craftsmanship determines the beauty of a stucco finish. It requires considerable artistry to develop new and attractive textures and combinations of colors that will harmonize with other materials, with the architectural style of the building, and with the setting in which it is placed.

"The building industry looks to the plasterer to create this beauty in plastic materials by methods which will insure permanent results. It has put the question squarely to him to decide whether he will accept this commission or allow other artisans and other materials to usurp his place and his work."

John H. Donlin

PORTLAND CEMENT ASSOCIATION

33 WEST GRAND AVENUE, CHICAGO

The activities of the Portland Cement Association, a national organization, are limited to scientific research, the development of new or improved products and methods, technical service, promotion and educational effort (including safety work), and are primarily designed to improve and extend the uses of portland cement and concrete. The manifold program of the Association and its varied services to cement users are made possible by the financial support of over 60 member companies in the United States and Canada, engaged in the manufacture and sale of a very large proportion of all portland cement used in these two countries. A current list of member companies will be furnished on request.

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SECTION I

PORTLAND CEMENT STUCCO

PORTLAND cement stucco and plaster are modern wall coverings which satisfy all requirements of durability and satisfactory appearance when properly applied.

These products actually are portland cement concrete. They resist fire. They have the plasticity which the plasterer wants. They harden slowly enough to permit texturing. They are durable—age increases their strength and density. Their cost is moderate.

It is important to remember, however, that practices commonly

followed in applying other plastering materials do not apply to portland cement stucco and plaster, because portland cement itself differs widely from other cementing agents such as lime, gypsum and magnesite.

This manual on recommended practice, therefore, has been prepared to help the plastering craft properly apply portland cement stucco and plaster.

The term "stucco" refers to outside work; "plaster," to inside work, in this manual.

Materials

Portland cement stucco is made with portland cement, aggregate and water. Other materials which may be required include (1) mineral pigments for color, (2) hair or fiber for scratch coat on back-plastered construction, and (3) plasticizing materials when increased workability is desired.

Portland Cement

Portland cement should meet the requirements of the current specifications of the American Society for Testing Materials.

Aggregate

Aggregate should be clean natural sand, or prepared from stone or blast furnace slag, free from harmful amounts of loam, silt, soluble salts and vegetable matter and should conform to the require-

ments of the current A.S.T.M. specifications for concrete sand, except that it should be graded within the following limitations:

Passing No. 4 sieve, 100%

Passing No. 8 sieve, 80 to 98%

Passing No. 16 sieve, 60 to 90%

Passing No. 30 sieve, 35 to 70%

Passing No. 50 sieve, 10 to 30%

Passing No. 100 sieve, not more than 10%

As in other forms of concrete work, the importance of proper grading of aggregate for portland cement stucco cannot be over-emphasized. The coarser the aggregate in the base coats (scratch and brown), within the screen sizes indicated above, the better. Care should be taken to select sands meeting these grading requirements that are at the same time well graded from fine to coarse without a preponderance of particles retained between any

successive screen sizes. This precaution applies particularly to the percentage of particles retained between the No. 30 and No. 50 standard screens. Where local concrete fine aggregates are deficient in the smaller sizes of fines, blending with available plastersands may provide suitable grading.

For finish coats, it may be necessary to use a somewhat finer aggregate, but it should be kept in mind that excessive fineness is one of the principal causes of crazing and cracking. Aggregate such as that used to obtain a fine sand-finish on interior plaster is not suitable for use in portland cement stucco.

Plasticizing Agents

Materials(excepting cement)used as "lubricators" or "fatteners" to increase workability of the mortar are referred to as "plasticizing agents". Diatomaceous earths, finely divided clays, asbestos flour or fiber, hydrated lime or lime putty, etc., or small amounts of admixtures known as "wetting agents" are common plasticizing agents. Some portland cements prepared for use in stucco contain the proper amounts of plasticizing materials ground in with the cement by the manufacturer at the mill. The use of such cement makes it unnecessary to add a plasticizing admixture on the job. Where such cements are not used and where admixtures are added on the job, care should be taken to use only the highest quality materials and then only in limited amounts. Use minimum quantity that will produce required workability. Ex-

cessive amounts reduce strength; increase porosity.

Water

Use only water that is fit to drink. It should be free from oil, acid, alkali and vegetable matter.

Mineral Pigments

Use only high-grade mineral pigments for coloring stucco. Such pigments have the highest color values and are most economical since less pigment is required to produce a desired effect. Do not use aniline base colors, other organic or vegetable dyes, or ordinary mortar colors.

Mix pigments in finish coat materials on the job only when factory-made portland cement stucco is not available.

It is possible to attain accuracy in measurement and thoroughness of mixing portland cement and

Coloring Materials

A general guide for the selection of coloring materials follows:

For maximum brightness and clearness of color and for light shades, use white portland cement.

For *white*, use white portland cement.

For *brown*, use burnt umber or brown oxide of iron. Yellow oxide of iron may be added to obtain modification of this color.

For *buff*, use yellow ochre or yellow oxide of iron. Red oxide of iron may be added in limited quantities.

For *gray*, use small quantities of black iron oxide, manganese black or Germantown lampblack.

For *green*, use chromium oxide. Yellow oxide of iron may be added.

For *pink*, use small quantity of red oxide of iron.

For *rose*, use red oxide of iron.

For *cream*, use yellow oxide of iron in small quantities.

mineral pigments in a factory-made product which ordinarily cannot be approached on the job.

In the event that factory-made portland cement stucco is not available, the use of colored cement, a commercial product obtainable in most markets, will be found best.

Bases for Portland Cement Stucco

Proper application of portland cement stucco requires that it be used either (1) as a material that is bonded to and becomes an integral part of the base to which it is applied, such as stucco on masonry, or (2) as a thin reinforced concrete slab anchored to the structure but not itself forming an integral part of the backing, such as stucco applied on metal reinforcement.

Masonry Walls as Stucco Base

Walls of concrete masonry are excellent bases for the direct application of portland cement stucco. The surfaces of masonry units should be rough to provide good mechanical key and should be free from paint, oil, dust, dirt, soot, or any material that might prevent satisfactory bond.

It is recommended that masonry cement or portland cement mortar be used in laying up masonry walls that are to be stuccoed. Joints may be struck off flush or slightly raked.

Old masonry walls softened by weathering, surfaces that cannot be cleaned thoroughly, such as painted brickwork, and *all chimneys*, must be covered with metal reinforcement before applying stucco. See "Metal Reinforcement," page 6.

If colored cement is not obtainable, then it will be necessary to mix the cement and mineral pigment on the job, in which case it is recommended that a ball mill be used for the purpose. Correct proportions of cement and pigment are determined by trial. See page 10.

Cast-in-place Concrete

Cast-in-place concrete walls having coarse or roughened surfaces are suitable bases for direct application of portland cement stucco. Such surfaces should be free from paint, oil, dust, dirt, soot or any material that might prevent satisfactory bond. When surfaces are not rough enough, prepare them as follows:

(1) Roughen old cast-in-place concrete walls with bushhammers or other special tools; wash thoroughly with water; let wall dry until suction is restored.

(2) Acid-washing, using a solution of 1 part muriatic acid to 6 parts water, is another method. First wet the wall with water so



Scratch coat is applied direct to masonry walls having a coarse texture.



Acid-washing cast-in-place concrete will improve the bond between the dash coat and the concrete surface. The acid is being applied with a scrubbing brush.

that the acid will act on the surface only. More than one application of acid may be necessary. After this treatment, wash the wall thoroughly with water to remove all acid. Let wall dry until suction is restored. If wall is not roughened sufficiently, use bushhammers.

(3) New cast-in-place concrete can be roughened with a heavy wire brush or a special scoring tool if forms are removed early, but do not remove forms before the concrete is hard enough to be self-sustaining. Never coat forms with oil or soap, as these are likely to remain on the concrete, interfering with stucco bond. Oil on the surface of concrete can be removed by washing with soap and water.

(4) Dashing on the first coat of portland cement stucco is another method when concrete walls are not sufficiently rough. See page 11.

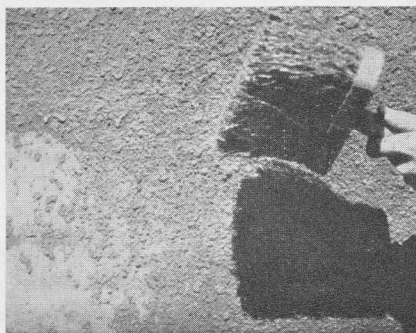
(5) Cast-in-place concrete surfaces also can be roughened by special compounds painted on the form faces. These retard hardening of the surface concrete. Roughness is obtained by brushing off surface material after forms are removed.

Metal Reinforcement

Metal reinforcement must be used for stucco applied on wood or steel frame structures of open or sheathed type, on masonry structures that do not provide satisfactory bond (*chimneys* and disintegrating surfaces), and on many old stucco surfaces. (See section on "Refinishing Old Stucco Jobs," page 12.) Metal reinforcement also is used wherever stucco is to be carried over flashing.

Structures to receive stucco on metal reinforcement should be well braced and rigid. In sheathed construction, see that studs are not more than 16 in. on center; are tied together below floor joists and bridged at least once every story height. Diagonal bracing at all corners, let into studs, is recommended to give additional rigidity. Place sheathing horizontally and nail it well on each stud. In open wood-frame construction, studs should be not over 12 in. on center. Brace them even more rigidly than in sheathed construction.

Cover surfaces to receive metal reinforcement (excepting areas to be back-plastered) with waterproof



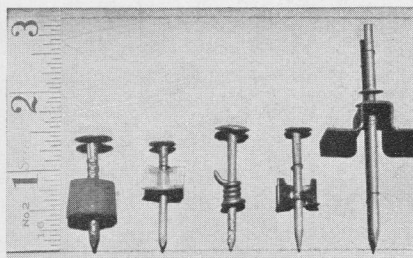
Dashing a first coat on cast-in-place concrete.

building paper. On open construction the paper serves as a backing for the scratch coat. In sheathed construction and on masonry surfaces requiring metal reinforcement, paper prevents absorption of moisture from fresh mortar. Attach paper with large-headed galvanized nails. Make upper strips overlap lower strips at least 3 in. Lap vertical joints at least 6 in. To support the paper and prevent tearing on open-frame construction, fasten wires (usually No. 18 gauge) tightly across the faces of the studs in single strands at 6 or 8-in. intervals.

Use large-mesh metal reinforcement—expanded metal, welded wire, or stucco netting of minimum net weight, 1.8 lb. per sq. yd. or 20 lb. per 100 sq. ft. For some jobs, a heavier product is desirable. Openings should not be less than $\frac{3}{4}$ in. in the small dimension nor larger than 3 in. in the large dimension and not exceed 4 sq. in. in area. For back-plaster construction, metal reinforcement weighing 3.4 lb. per sq. yd. is recommended.

Large openings in the reinforcement are desirable so that mortar will be pushed through to backing, completely embedding the metal. Where there is no backing, as in work to be back-plastered, reinforcement of relatively small mesh (metal lath or wire lath) is necessary. Complete coverage of the metal in the latter case is obtained when back-plaster coat is applied.

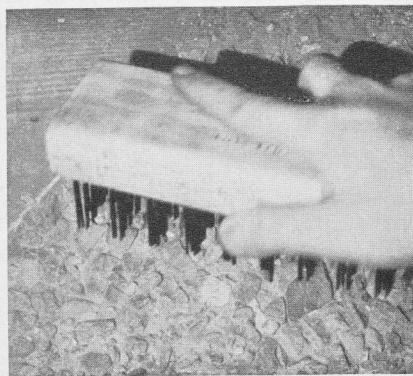
Attach reinforcement securely. Nailing or stapling it flat against the face of studs or sheathing is poor practice. Have it furred out at least $\frac{1}{4}$ in. so that stucco can be



Several types of furring nails—to accommodate practically any of the types of metal reinforcement available.

forced behind the metal. Use furring nails or other furring devices that will not reduce the thickness of the stucco. Nails should have a penetration into supports of not less than 1 in. Solid furring strips which cut into the stucco slab are objectionable. They make lines of weakness and may cause cracking.

Reinforcement should form a continuous network of metal over the entire surface. Laps at ends and sides of large mesh reinforcement should be at least one mesh and not less than 2 in. For small mesh types, laps should be at least 1 in. Laps should be wired securely. Lapping of ends of reinforcement should be staggered.



Another method of preparing cast-in-place concrete to receive stucco. A special compound painted on the forms retards hardening in the surface concrete, permitting the aggregate to be exposed by brushing.

Carry sheets of reinforcement around corners at least one stud spacing on open-frame construction; at least 4 in. on other types.

Overcoating

In refinishing old buildings having weatherboard or shingle siding,

weatherboards or shingles may be removed or left in place. In the latter case, re-nail any loose pieces and build out trim to provide proper projection. Waterproof paper and metal reinforcement must be applied. See page 28 for overcoating details.

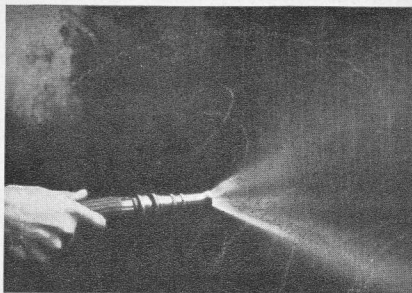
Suction

Suction is absolutely necessary in order to get the proper bond of stucco on masonry or cast-in-place concrete. It is also necessary in first and second coats so that succeeding coats will bond properly.

Uniform suction helps to obtain uniform color. If one part of the wall draws more moisture from the stucco than another, the finish coat may be spotty.

Obtain uniform suction by dampening, but not soaking, the wall evenly before applying the stucco. If the surface becomes dry in spots, dampen these areas again to restore uniform suction. A fog spray is recommended for this work. Work on the shady side of buildings when

possible, for it is hard to keep walls damp when they are exposed to the sun. If waterproofing is used in base coat mortar, dampening the first and second coats to obtain uniform suction may not be required except in hot, dry weather.



A fog spray is recommended for dampening the wall to develop proper suction.

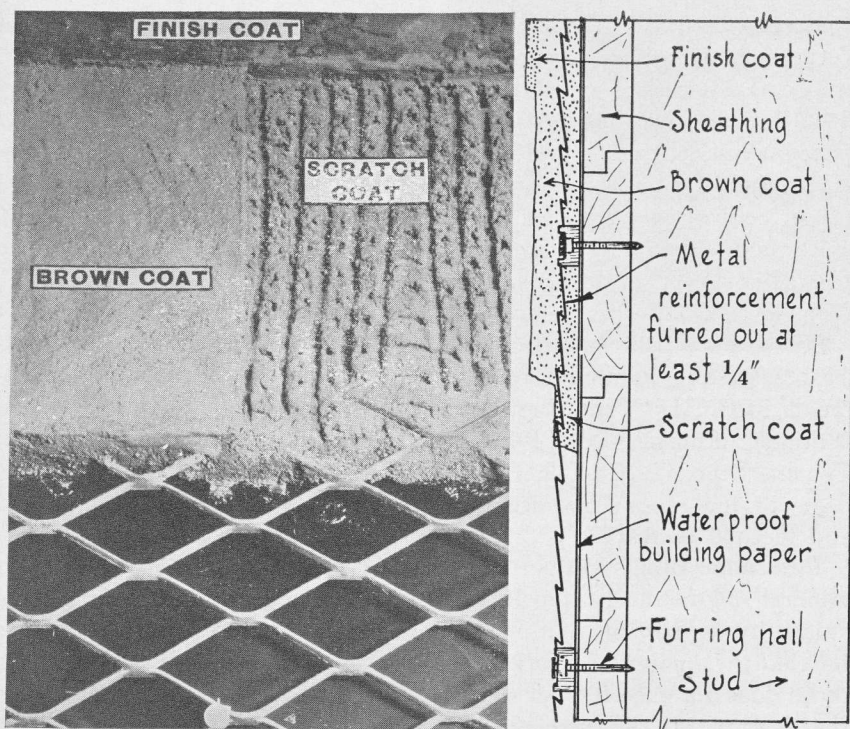
Curing

To develop maximum strength and density it is necessary to cure portland cement stucco properly. *Keep brown and finish coats damp continuously for at least two days.* Begin moistening each coat as soon as the stucco has hardened sufficiently not to be injured, applying the water in a fine fog spray. Avoid soaking the wall. Give it only as much water as will be readily absorbed. To prevent excessive evaporation in hot, dry weather,

hang tarpaulins over the outside.

After the damp-curing period, allow the stucco coat to dry thoroughly before the next is applied. The practice of doubling coats is not good construction practice.

When stucco is applied during cold weather, longer curing periods are necessary. In freezing weather, do not apply stucco unless special methods are employed to keep the materials at a temperature above 50 deg. F. for at least 48 hours.



Showing proper construction for stucco on metal reinforcement. Note the backing of waterproof building paper, the metal reinforcement held at least $\frac{1}{4}$ inch away from the backing with furring nails, and the scratch coat filled in solidly behind the metal.

Proportioning and Mixing

Each coat of stucco should be not richer than 1 part of portland cement to 3 parts of damp, loose aggregate. Where aggregate is well graded with a good proportion of coarse particles a 1:3½ or 1:4 mix may be found satisfactory. If necessary, a plasticity agent may be used to increase workability of the mortar. Some portland cements prepared for use in stucco contain the proper amount of plasticizing material ground in with the cement by the manufacturer at the mill. The use of such cements makes it unnecessary to add a plasticizing admixture on the job. Where a

plasticizing agent is added on the job, the amount required will vary with the kind of agent used, the grading of the aggregate, proportion of cementing materials and aggregate and other factors. The kind and amount of plasticizing agent necessary for proper workability should be determined in advance of starting the job. Use smallest amount possible to secure desired plasticity. The use of rich mixes or large amount of admixtures is likely to result in crazing or other damage.

To secure the desirable strength and durability properties of port-

land cement stucco, the minimum average compressive strength of the stucco at 28 days of age should be 2,000 lb. per sq. in. when molded and tested as 2-in. cubes. Portland cement stucco should not absorb more than 10 per cent of its weight of water.

Method of making specimens and tests should be in accordance with A.C.I. C3-C-29T. See page 13.

Stucco for finish coats should at least meet the minimum requirements in A.C.I. "Tentative Specifications, Finish Coat Portland Cement Stucco" (C3-C-29T). See page 13 for general requirements and method of testing.

Determine proper proportion of mineral pigments in finish coat stucco by experiment. In general, see that the amount of coloring material does not exceed 6 per cent of the weight of the cement. To obtain maximum clearness and brightness in colored finishes, white portland cement should be used. White finishes are obtained by using white cement and light-colored aggregate. A general guide to the selection of mineral pig-

ments is given in the table on page 4.

Measure materials accurately and proportion all batches exactly alike. Because variations in moisture content of aggregates cause changes in volume due to bulking, use only aggregates of uniform moisture content.

Mix materials to a uniform color before water is added; then wet-mix them to the desired consistency. Thorough mixing is essential. Hand-mixing is satisfactory if done thoroughly, but machine-mixing usually gives greater uniformity. Run the mixer at least five minutes after all ingredients are in the drum. In hand-mixing, hoe the batch back and forth 10 to 15 minutes after the water is added.

Stucco mortar made with normal portland cement is not injured by standing 2½ to 3 hours if it is re-mixed frequently without adding water. Let stucco stand at least 1 hour before using it. Never use stucco after it has hardened due to setting of the cement. Do not use admixtures to hasten set.

Flashing

Flashing is vital to satisfactory results. Design and place it so water will not get behind the stucco. Place continuous flashing under all copings, cornices, belt courses and multiple-piece sills to prevent entry

of water. Use only high-grade rust-resisting material. It is folly to use a short-lived metal with so permanent a wall covering as portland cement stucco. See drawings, pages 29 to 32, for flashing details.

Application

The Scratch Coat

Make the scratch coat approximately ⅜ in. thick measured from

the face of the backing and carry it the full length of the wall or to natural breaking points like doors

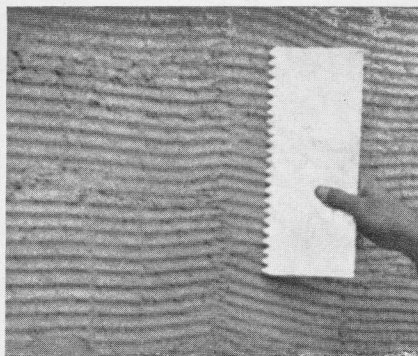
or windows. Before the scratch coat hardens, cross-scratch it to provide mechanical key for the brown coat.

Masonry walls on which stucco is to be applied direct should be clean and dry. But, before applying the scratch coat, dampen the surface evenly to control suction. (See page 8.) Apply the scratch coat with heavy pressure.

On cast-in-place concrete walls, dash the first coat on unless the surface is sufficiently rough to insure adequate bond for a scratch coat applied with a trowel. Rough surfaces that permit successful application with the trowel are produced by mechanical roughening or through the use of special compounds. (See page 5.) Surfaces treated by acid-washing generally are not rough enough, in which case a dash coat is necessary. Dashing on the first coat aids in getting good bond by excluding air which might otherwise be trapped behind the stucco.

Apply the dash coat with a whisk broom or fiber brush, using a strong whipping motion at right angles to the face of the wall, or with a stucco machine or cement gun. In either case, project it with considerable force. Use mortar of a mushy consistency, composed of 1 part portland cement to 1½ parts aggregate. Keep damp for at least two days immediately following its application. Then allow it to dry thoroughly.

On metal reinforcement, completely embed the metal in mortar. This is easy when the large-mesh type of reinforcement is used, for openings are large enough to per-



This type of scratcher not only makes broad impressions but when used at an angle also roughens the surface between furrows. Scratching should be done horizontally so that when moisture is applied it will be retained in the wall to aid curing.

mit scratch coat mortar to pass through readily. Metal which is not embedded completely is likely to rust out within a few years. In back-plastered construction, the back-plaster coat assures complete coverage of the metal. This is $\frac{3}{8}$ in. of mortar applied to the back of the reinforcement after the scratch coat has hardened enough so pressure will not break the plaster keys.

The Second or "Brown" Coat

Before starting to apply the brown coat, dampen the surface of the scratch coat evenly as described under "Suction," page 8. Make the brown coat about $\frac{3}{8}$ in. thick. This coat may be applied in two thin coats, one immediately following the other. Such a method may prove helpful in applying sufficient pressure to insure a proper bond with the base coat. Bring it to a true, even surface; then roughen with a wood float or cross-scratch it lightly to provide bond for finish coat. Damp-cure the brown coat for at least two days; then allow it to dry.

The Finish Coat

There should be at least a 7-day interval between application of the brown coat and finish coat. Before applying the finish coat, dampen the brown coat evenly as described

under "Suction," page 8. Whenever possible, apply texture coat from top to bottom in one operation to eliminate joining marks. See pages 14 to 22 for textures. If the finish coat is factory-made material, follow manufacturer's directions closely.

Refinishing Old Stucco Jobs

Old stucco jobs may be resurfaced to renew finish and change color or texture, or both. The new stucco may be applied direct provided the old stucco is sound. If original stucco is unsound, it is necessary to remove the old material entirely and apply a new three-coat job.

Where old stucco is not removable, it is necessary to cover the old surface with paper and metal reinforcement and then apply the standard three coats.

How to Prepare Surface

Prepare sound stucco surfaces for refinishing as follows:

Wet the entire area; then clean it with a solution of 1 part muriatic acid and 6 parts water. After acid-treatment, wash it thoroughly with water to remove all traces of the

acid. Allow wall to dry thoroughly; then moisten it just prior to applying the new coat. On surfaces of coarse or rough texture, the new finish may be a single coat applied with the trowel. If the old surface lacks roughness, apply two coats, dashing on the first to establish bond.

After the dash coat is properly cured, as described on page 11, trowel on the finish coat.

Never apply portland cement stucco directly over lime, gypsum or magnesite stucco. These materials either should be removed entirely or they should be covered first with waterproof paper and metal reinforcement. See pages 6 to 8.

In either case, apply the standard three coats of portland cement stucco.

Causes of Discoloration

The most common causes of discoloration are:

Failure to have uniform suction in either of the base coats.

Improper flashing, and corrosion of flashing or metal attachments. (See pages 29 to 32, inclusive, for flashing details.)

Poor mixing of finish coat mate-

rials and use of inferior pigments.

Changes in materials or in proportions during progress of a job.

Variations in amount of mixing water.

Failure to provide drips and washes on sills and projecting trim.

Use of additional water to re-temper mortar.

Tentative Specifications, Finish Coat Portland Cement Stucco (C3-C-29T) of the American Concrete Institute 1929

The study of finish coat stuccos by the Institute's Subcommittee 1 of Committee C3 on Stucco, which preceded the formulation of these specifications, indicated that frequently poorly graded aggregates are used, which necessitates the use of either very rich mixes or the addition of large amounts of plasticizing agents. It is felt that the use of very rich mixes is inadvisable because it tends toward crazing and shrinkage cracks. To guard against excess fines, the specification limits the amount of material passing a 100-mesh screen to 35 per cent of the total weight of the sample. This includes the cement and all other fine materials.

In preparing the specification the importance of plasticity was given careful consideration. Comparison of test results and the known plasticity of many of the stuccos indicates that plasticity is and can be easily obtained without sacrificing quality.

While a direct relation cannot be established between the test results on cubes made and cured in the laboratory and stucco as applied to the wall, it is believed that the test procedure outlined sets up a standard of quality that will insure reliable portland cement finish coat material.

I. GENERAL

1. The purpose of these specifications is to establish minimum requirements for finish coat portland cement stucco.

2. The term "finish coat portland cement stucco" shall be understood to mean a portland cement mortar used to cover or decorate preceding coats of portland cement stucco or other suitable bases on exterior walls and surfaces exposed to the elements.

3. The minimum average compressive strength of finish coat portland cement stucco at 28 days of age shall be 2000 lb. per sq. in. when molded and tested as 2-in. cubes in the manner hereinafter specified.

4. Finish coat portland cement stucco shall not absorb more than 10 per cent of water when tested as hereinafter specified.

5. Finish coat portland cement stucco shall not contain more than 35 per cent by weight of the whole sample of material passing the 100-mesh sieve.

6. If pigments are used, they shall be pure mineral oxides guaranteed by the manufacturer to be of uniform quality and proof against action of lime and sun.

II. METHOD OF MAKING SPECIMENS

7. Finish coat stucco to be used in making specimens for all tests shall be mixed to plastering consistency. The approximate amount of water required to mix any stucco to plastering consistency shall be indicated by the manufacturer of that stucco.

8. In making specimens, molds shall be filled in two layers, each layer being lightly puddled with the finger. Stucco shall be left heaped on molds and be struck off at the end of 3 to 4 hours. Immediately after molding, specimens shall

be covered with moist burlap for 24 hours, then removed from the molds.

9. After removal from molds specimens shall be immersed in water for 6 days and thereafter stored 21 days in dry air of the laboratory at approximately 70 deg. F. Specimens shall be tested at age of 28 days.

III. METHOD OF TESTING

10. Not less than 3 and preferably 5 specimens shall be required for each test. In the event of failure of the first set of specimens, the test shall be repeated on a second set of specimens.

11. Absorption tests shall be made on 2-in. cubes. After being cured, as provided in paragraph 9, they shall be carefully weighed and then completely submerged in water at a temperature of between 60 and 80 deg. F. for 24 hours. Specimens shall then be removed, the surface water wiped off with a damp cloth and the specimens quickly weighed. The percentage of absorption is the difference in weight divided by the dry weight of the specimen and multiplied by 100.

12. Specimens for compression test shall be tested in a vertical testing machine of not exceeding 50,000 lb. capacity. Load shall be applied through a spherical bearing block placed on top of the specimen. The dimensions of the bearing block shall be the same or slightly greater than those of the specimen.

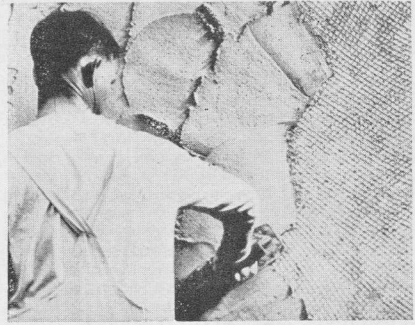
13. Load shall be applied uniformly and without shock. The speed of the moving head of the testing machine shall be not more than 0.05 in. per minute when the machine is running idle.

14. Specimens shall be loaded to failure and unit compressive strength calculated in pounds per square inch. The type of failure and appearance of the specimen shall be noted.

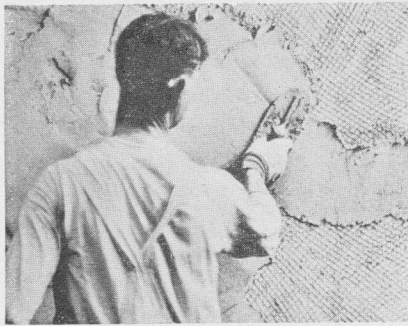
SPANISH TEXTURE



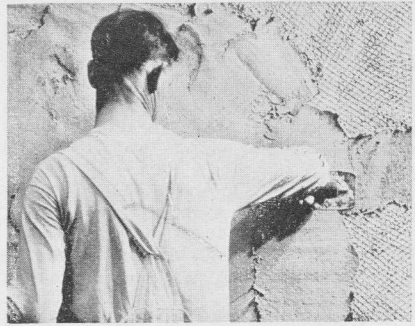
1. Apply finish coat in rather heavy layers, using round-point trowel—a full trowel of fairly stiff mortar for each stroke.



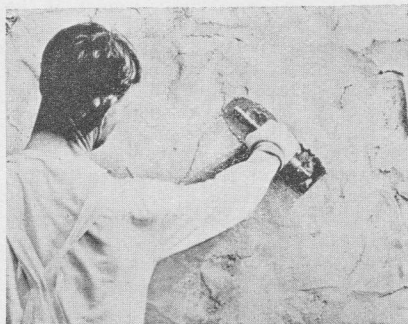
2. Make strokes in all directions, curving and varying them to form rolling ridges and hollows in the finished surface.



3. A left horizontal stroke. Uniform dampening of brown coat helps spread this finish; makes mortar stand as placed.



4. Irregular overlapping helps, but avoid excessive troweling in producing any portland cement stucco texture.

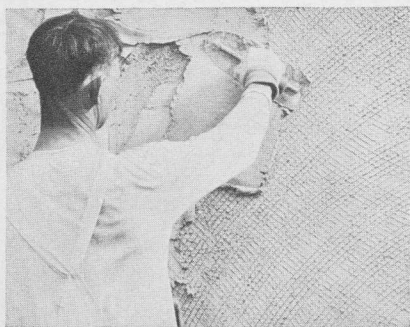


5. Smoothing out rough edges with round-point trowel before mortar hardens to a point where workability is lost.



6. A wavy, trowel-marked finish, with stucco compacted and surface pores closed—the popular Spanish Texture.

CALIFORNIAN TEXTURE



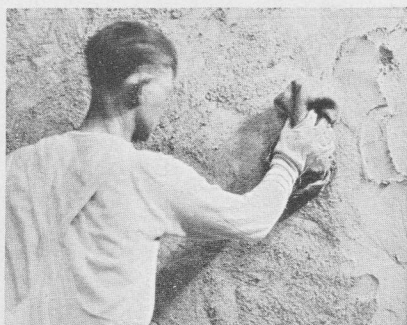
1. Use full sweep spreading as in creating the Spanish Texture, stroking full trowels of mortar in all directions.



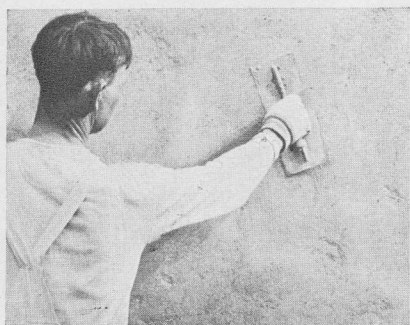
2. Creating this texture requires a rounded trowel, as there are no straight-line markings. Use only curved strokes.



3. Preliminary appearance. Notice that full trowels of mortar are left in place without additional smoothing.



4. Before mortar hardens, rub its surface down with a wadded piece of burlap to produce a wavy, irregular, coarse surface.

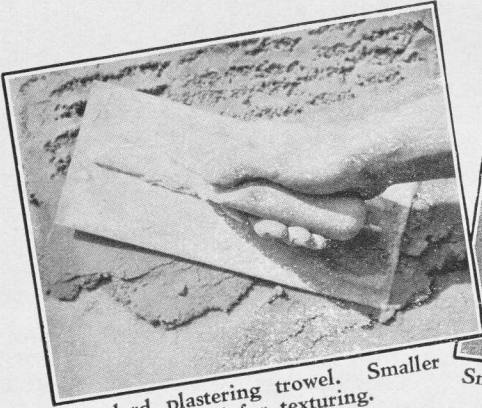


5. To finish texture, trowel entire area, creating highlights. Force sand particles into mortar, compacting the surface.

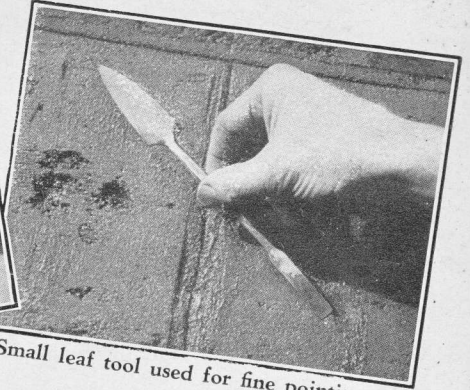


6. Californian Texture is a rubbed, troweled finish—like plaster over an irregular surface, with the added touch of highlights.

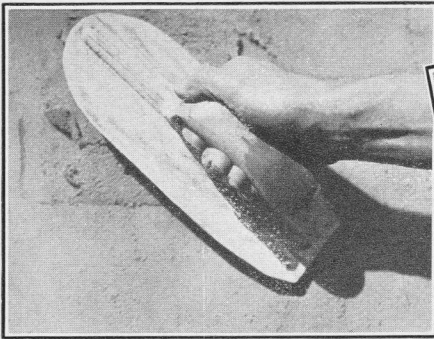
Plastering and



Standard plastering trowel. Smaller size used for texturing.



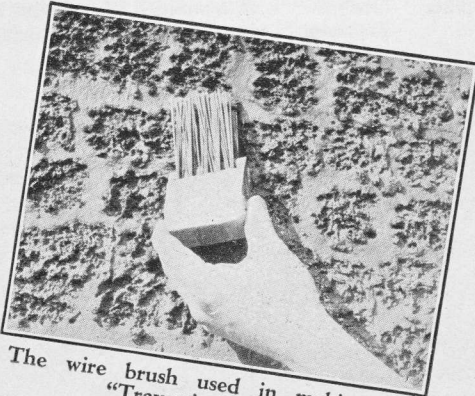
Small leaf tool used for fine pointing.



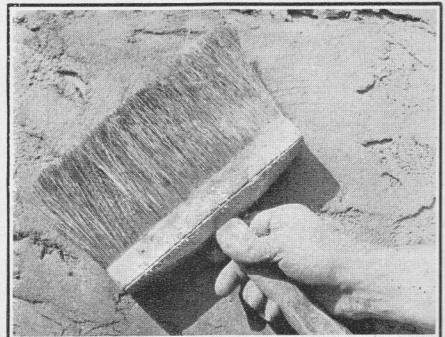
A round point trowel.



Wood float. Covered with carpet to produce sanded finish.

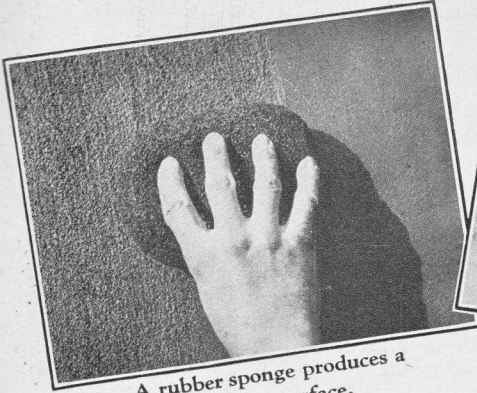


The wire brush used in making the "Travertine" texture.

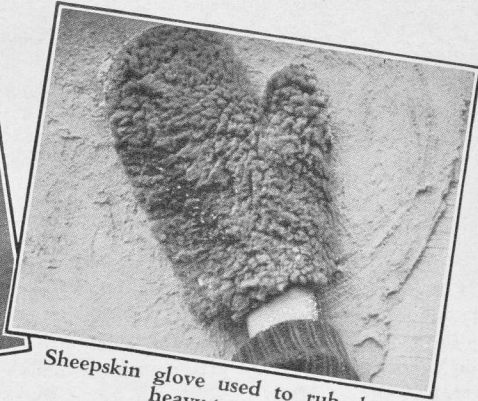


The Dutch brush used for applying washes or for softening rough textures.

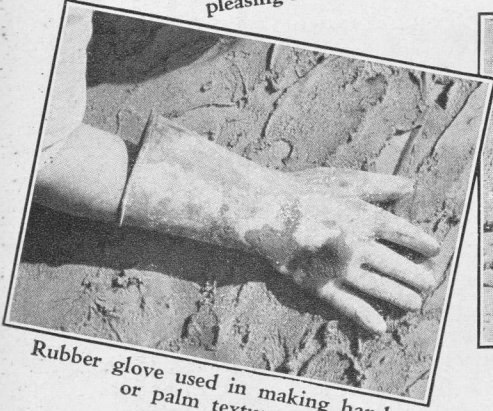
Texturing Tools



A rubber sponge produces a pleasing surface.



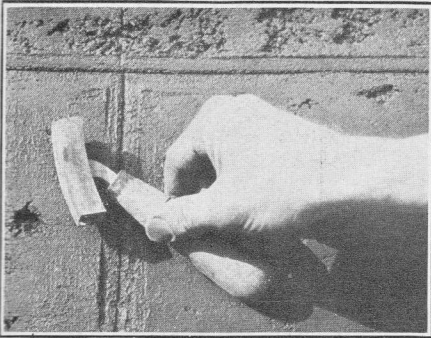
Sheepskin glove used to rub down heavy textures.



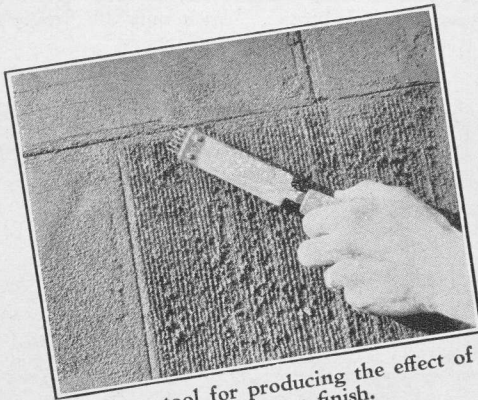
Rubber glove used in making hand or palm textures.



A cork float.



The jointing tool for marking off surfaces to resemble masonry.



Combing tool for producing the effect of a tooled stone finish.

ITALIAN TEXTURE



1. Applying thin backing coat over entire surface to insure uniform color, even though dash coat may not give complete coverage.



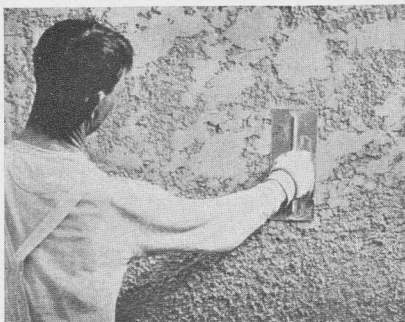
2. Dashing small quantities of mortar (it may be a different color, if polychrome effect is desired) with quick strokes of whisk broom.



3. Method of holding bucket for spatter-dash work. Bundle of reeds may be used instead of whisk broom. Cover only 30 sq. ft. of wall at a time.



4. Close-up showing spatter-dash finish. Allow this dash coat of mortar to set partially before beginning the final finishing.

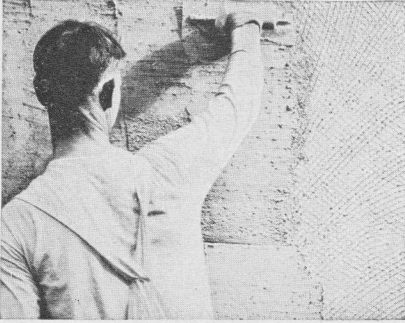


5. To finish, place trowel flat against dash coat; draw it evenly across wall, left to right. Smoothing return stroke erases possible trowel marks.



6. A troweled, spatter-dash finish. Uniform appearance produced by keeping time constant between dashing and troweling each section of wall.

ENGLISH COTTAGE TEXTURE



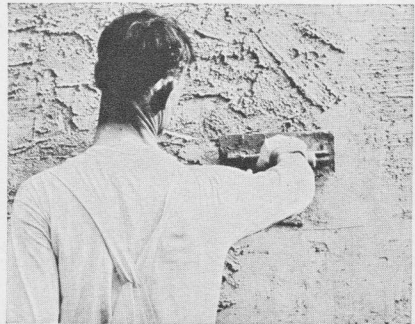
1. Applying thin backing coat about $\frac{1}{8}$ in. thick. Portions of this are exposed in final texture; other portions provide base for added mortar.



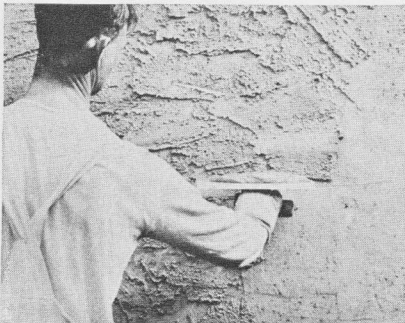
2. Feathering with square trowel, as small amounts of mortar are added with short, twisting strokes at varying angles to the wall.



3. Showing how stucco is pinched off in all directions. Avoid vertical or nearly vertical strokes when feathering with square trowel.



4. Use a twisting, feathering application. By twisting the trowel as a pat of mortar is applied, slightly curved ridges are formed.

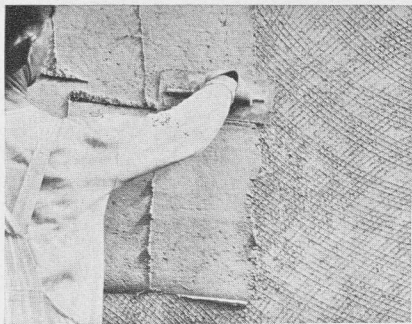


5. Small trowel of mortar. Variations of this texture are obtained by varying amount of mortar, directions and length of strokes, and twisting motion.

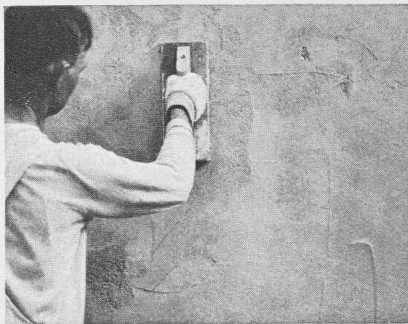


6. The English Cottage Texture is a fine, leaflike finish. Heavier applications than those shown in Fig. 5, however, are sometimes desirable.

COLONIAL TEXTURE



1. Applying brown coat for Colonial Texture, which is one of the most popular portland cement stucco finishes. Use a square trowel.



2. Floating brown coat with wood float to insure a regular, even surface. Use circular motion to produce an even but comparatively coarse texture.



3. Applying finishing mortar in a very thin, hard coat. Allow to stand until hardened sufficiently to permit working without rubbing off.



4. Wetting with a brush may be necessary to moisten the wall enough to permit rubbing with a carpet float, the final finishing step.



5. Carpet floating the surface. Use a circular rubbing motion, which produces an evenly sanded finish that is devoid of texture.

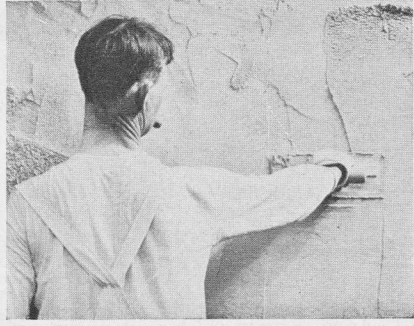


6. A smooth, sand-floated surface. Use the lighter tints—white, ivory, buff or occasionally a pale cream yellow—for this finish.

MODERN AMERICAN TEXTURE



1. Covering application (about $\frac{1}{4}$ in. thick) for this rough-torn texture. Mortar coat is rather heavy to permit roughening later.



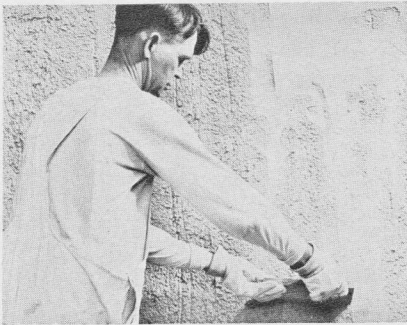
2. Full spread placing is the best method to produce the preliminary finish. Make no special effort to remove trowel marks.



3. Appearance of preliminary finish. This is to be rough-torn by drawing the edge of a wood block up the face of the wall.



4. Showing how to make a lightly torn surface. Never use a downward stroke. Tilt the block at an angle as it is drawn up.

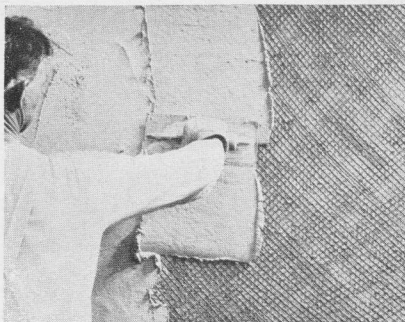


5. To tear the surface lightly, hold the board in one hand; if heavier texture is desired, use both hands, as shown in above photograph.



6. Modern American Texture is a tapestry finish. Its surface may be lightly brushed with a different color pigment than used in the mortar.

ITALIAN TRAVERTINE TEXTURE



1. Apply a very thick coat of mortar (about $\frac{3}{8}$ in. thick) to a well-dampened brown coat that will retard hardening and permit texturing operations.



2. Trowel finish coat fairly smooth. Then stipple deeply, using whisk broom or wire brush to pull up an irregular texture.



3. Hold the brush at an angle, as shown above. Stippling should be irregular in appearance. See photograph in Fig. 4.



4. This photograph shows appearance after stippling. This surface is later troweled while it is still plastic and workable.



5. Troweling horizontally smooths out the higher portions of the texture. Depressions made by stippling remain rough; furnish veined effect.



6. This texture is a stippled, troweled finish. Greater pressure on trowel will give finer veining. Cut joints with jointing tool. See page 17.

SECTION II

PORTLAND CEMENT PLASTER

PORTLAND cement plaster is the best interior finish where walls, partitions and ceilings are subject to rough usage or extreme moisture conditions. It is used in

basements, steamrooms, vapor baths, toilet rooms, swimming pools, garages, storerooms, elevator shafts and in other places subjected to hard service.

Materials

Specifications for cement, grading of aggregates, use of plasticizing agents, water requirements and the use of mineral pigments and colored cement for portland cement plaster are the same as for portland

cement stucco. (See pages 3 and 4.) For scratch coat mortar on metal reinforcement, use only first quality long hair free from foreign matter, long fiber well combed out, or a combination of both.

Bases for Portland Cement Plaster

Portland cement plaster may be applied to masonry, cast-in-place concrete and metal reinforcement bases. Applying the scratch coat differs for each type of base, but the brown and finish coats are applied in the same manner regardless of the type of base.

Masonry

Concrete masonry partitions and ceilings are excellent bases for applying portland cement plaster direct. Concrete and clay furring tile and exterior masonry walls, which may not require furring, also are plastered direct.

All masonry units to which plaster is applied direct should have faces sufficiently rough to provide mechanical key. Always use ma-

sonry cement or portland cement mortar in laying up masonry walls that are to receive portland cement plaster. Joints may be raked or struck off flush. Clean the surfaces to remove all dust, dirt, soot, oil, paint or any other material that might interfere with bond.

Cast-in-place Concrete

Cast-in-place concrete walls and ceilings having coarse or roughened surfaces are suitable bases. When surfaces are not rough or coarse enough to provide mechanical key, it is necessary to prepare them in one of the ways described on pages 5 and 6.

Metal Reinforcement

Metal reinforcement is used as a

base for portland cement plaster applied on stud partitions, furred or suspended ceilings, wall board or plaster board, gypsum furring tile and such masonry or cast-in-place concrete walls as require furring. Cover gypsum furring tile with waterproof building paper before applying reinforcement.

Use metal reinforcement that will readily embed in the plaster. This may consist of strands of wire (wire lath) or narrow strips of metal (expanded metal lath).

Reinforcement must have sufficient weight to provide a rigid plastering surface between supports. Never space supports more than 16 in. apart. Where studs or joists are already placed more than 16 in. apart, use furring channels or other supports. For the maximum spacing of 16 in., reinforcement weighing 3.4 lb. per sq. yd. will give the required rigidity. Sometimes, 2½-lb. reinforcement for walls; 3-lb. for ceilings, is specified where sup-

ports are only 12 in. apart, although many plastering contractors prefer to keep fewer stocks on hand and use but one weight—3.4 lb. for all spacings up to the maximum of 16 in. The reinforcement should be painted, galvanized or otherwise protected against corrosion.

To provide a continuous, rigid network of reinforcement over the entire area, lap sheets at least 1 in. on sides and ends, lace securely with galvanized wire, and fasten on 6 or 8 in. centers to every support they cross.

Do not fasten reinforcement flat against the face of supporting members or backing, but fur it out so it will be completely embedded in the plaster. This reduces possibility of cracking.

Furring out reinforcement provides for uniform plaster thickness and helps prevent dark streaks such as are frequently found on plaster, especially on ceilings.

Suction

Suction is necessary in masonry and cast-in-place concrete bases and in each coat of portland cement plaster. Refer to page 8.

Curing

Since portland cement plaster is generally exposed to severe use, it should be given every opportunity to develop its maximum strength and density through proper curing. Methods of curing portland cement stucco as described on page 8 also

apply to portland cement plaster. Follow them carefully. Interior plaster usually dries more slowly than stucco, so allow additional time for complete drying after each curing period. Protect portland cement plaster against freezing

during the hardening period. In enclosed buildings there is little danger of freezing, except in severe

weather. In this case use artificial heat, but take care that the plaster is not dried out before it is cured.

Proportioning and Mixing

Proportions of materials for portland cement plaster and directions for mixing are exactly the same as for portland cement stucco as de-

scribed on page 9. For scratch coat mortar on metal reinforcement, add hair or fiber. Usually 1 lb. per sack of cement is enough.

Application

The Scratch Coat

Apply portland cement plaster on *masonry* walls and ceilings in the same manner as portland cement stucco. See page 10.

Apply the scratch coat on *cast-in-place concrete* walls in the same manner as the scratch coat of portland cement stucco. It is dashed on, or, if the wall is rough enough, it may be troweled on. See page 11. To get tight bond on cast-in-place concrete ceilings, always dash on portland cement plaster.

On *metal reinforcement*, spread the scratch coat mortar with relatively light pressure. The hair or fiber in the mortar helps form plaster keys that hold mortar in place.

The Brown Coat

Apply the brown coat of portland cement plaster in the same manner as the brown coat of portland cement stucco. See page 11. Use grounds to get uniform thickness.

The Finish Coat

Cure the brown coat and let it

dry as described under "Curing," page 8, before applying the finish coat. The usual finish on interior portland cement plaster is either a sand float as shown on page 20, or a texture of low relief.

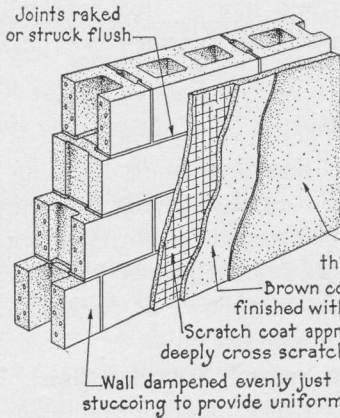
If a smooth troweled finish is specified, use a float for preliminary finishing and use a trowel only to force the sand particles down into the plaster, and leave the surface smooth. Moist-cure for at least 7 days.

Painting

Portland cement plaster may be painted with either oil or water paints. If water paint is used, follow manufacturers' instructions.

If oil paint is used, allow the surface to dry thoroughly. Then cover it with a solution of zinc-sulphate mixed in the proportion of 2 or 3 lb. of crystals to 1 gal. of water. Allow the surface to dry 48 hours; then brush off zinc-sulphate crystals. Never apply the solution before the wall is completely dry. After removing crystals, size the walls with oil or varnish; then paint.

SECTION III CONSTRUCTION DETAILS



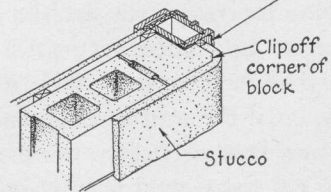
CONCRETE TILE OR BLOCK WALL

Lintels should have coarse texture or be roughened to secure adequate bond

Soffit sloped outward to provide drip
 Brick mold placed after stucco is applied

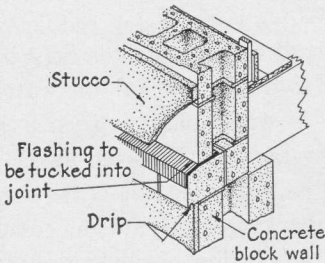
DETAIL OF WINDOW HEAD

Brick mold placed after stucco is applied

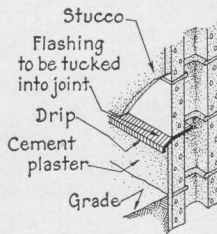


DETAIL OF WINDOW JAMB

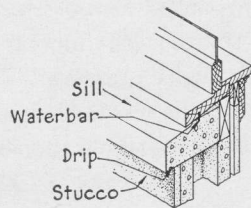
Note:- Drip on belt courses, sills etc. must project clear of stucco.



DETAIL OF FLASHING
WATERTABLE OR BELT COURSE



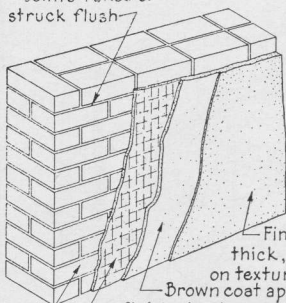
METHOD OF STOPPING
STUCCO WHERE NO BELT COURSE
OR SOLDIER COURSE IS PROVIDED



DETAIL OF WINDOW SILL

STUCCO ON CONCRETE MASONRY

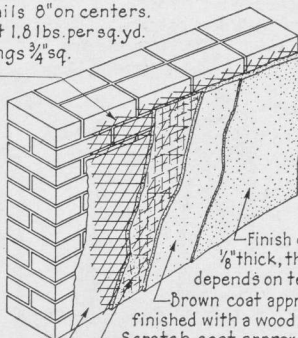
Joints raked or struck flush



Metal reinforcement furred out $\frac{3}{8}$ " with furring nails 8" on centers. Minimum weight 1.6 lbs. per sq. yd. Minimum openings $\frac{3}{4}$ " sq. Maximum 2" sq.

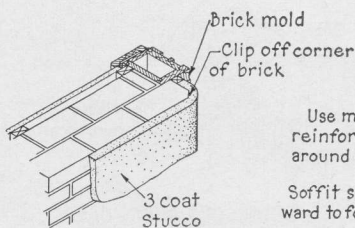
Finish coat approx. $\frac{1}{8}$ " thick, thickness depends on texture.
Brown coat approx. $\frac{3}{8}$ " thick finished with a wood float.
Scratch coat approx. $\frac{3}{8}$ " thick and deeply cross scratched.
Wall dampened evenly just before stuccoing to provide uniform suction.

HARD OR MEDIUM CLAY BRICK UNPAINTED

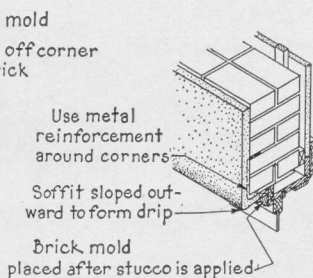


Finish coat approx. $\frac{1}{8}$ " thick, thickness depends on texture.
Brown coat approx. $\frac{3}{8}$ " thick finished with a wood float.
Scratch coat approx. $\frac{3}{8}$ " thick deeply cross scratched.
Waterproof building paper weighing 15 lbs. or more per square.

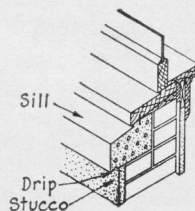
SOFT CLAY BRICK OR BRICK WITHOUT ROUGH FACES OR PAINTED BRICK



DETAIL OF WINDOW JAMB

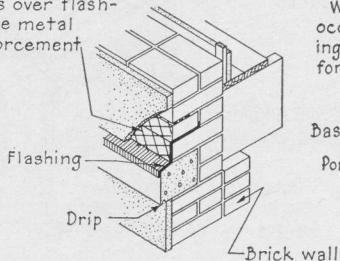


DETAIL OF WINDOW HEAD



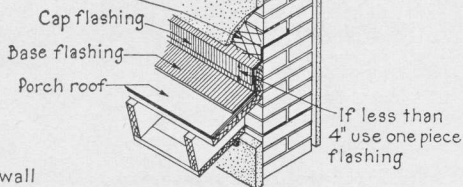
DETAIL OF WINDOW SILL

Where stucco occurs over flashing use metal reinforcement



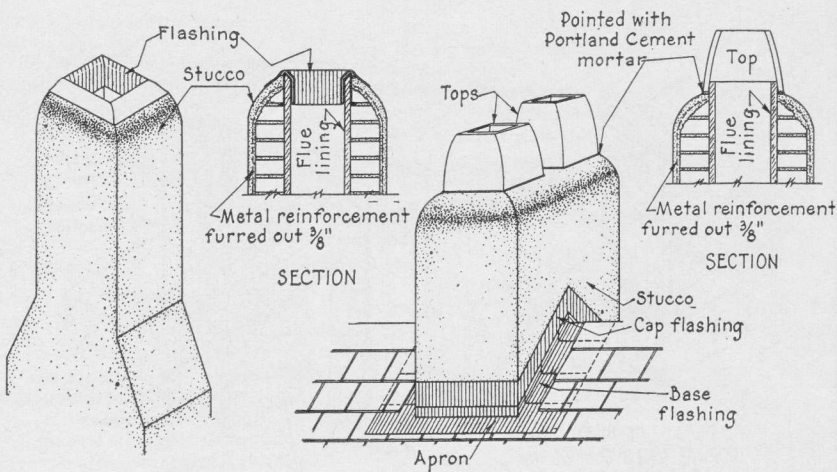
DETAIL OF FLASHING WATER TABLE OR BELT COURSE

Where stucco occurs over flashing use metal reinforcement



DETAILS OF FLASHING WHERE PORCH ROOF ABUTS BRICK WALL

STUCCO ON BRICK

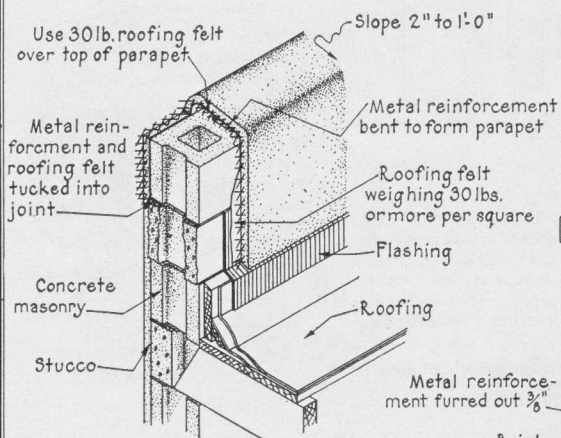


DETAIL OF SPANISH TYPE CHIMNEY WITHOUT TOP

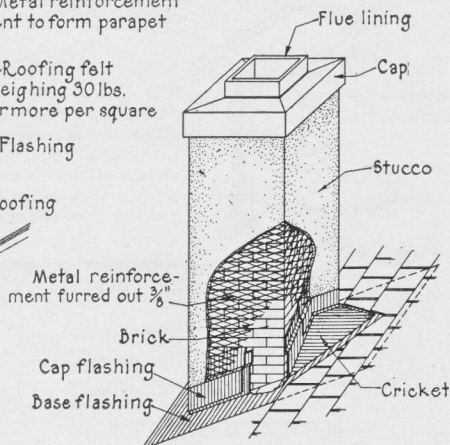
DETAIL OF SPANISH TYPE CHIMNEY WITH TOPS

Note:-

Metal reinforcement furred out $\frac{3}{8}$ " with furring nails 8" on centers. Minimum weight 1.8 lbs per square yard. Minimum openings $\frac{3}{4}$ " square. Maximum 2" sq.



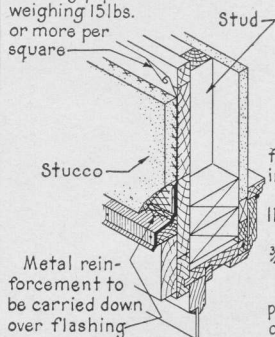
DETAIL OF FLASHING ON CONCRETE MASONRY PARAPET WALLS



DETAIL OF FLASHING AROUND CHIMNEY

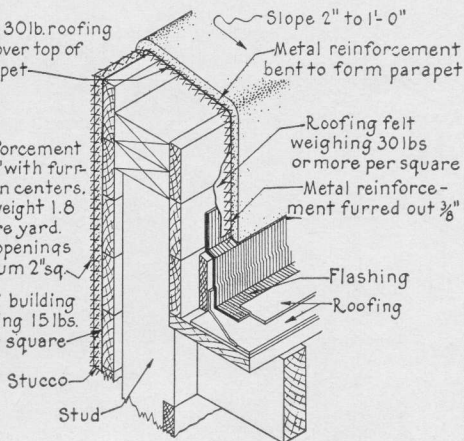
FLASHING DETAILS CHIMNEY AND ROOF

Waterproof building paper weighing 15 lbs. or more per square

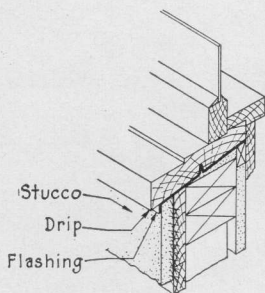


DETAIL OF FLASHING OVER WINDOW OPENING

Use 30 lb. roofing felt over top of parapet



DETAILS OF FLASHING ON STUCCO COVERED PARAPET WALLS

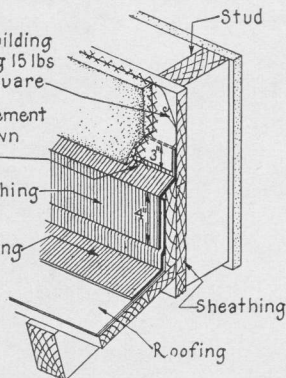


DETAIL OF FLASHING FOR WINDOW SILL

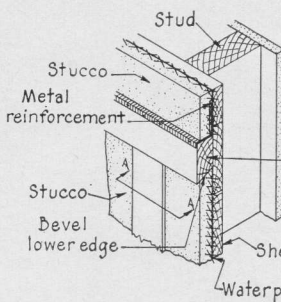
Waterproof building paper weighing 15 lbs or more per square
Metal reinforcement to be carried down over flashing

Cap flashing

Base flashing



DETAIL OF FLASHING WHERE PORCH ROOF OR DORMER ABUTS A STUCCO WALL



FLASHING FOR HALF-TIMBER CONSTRUCTION

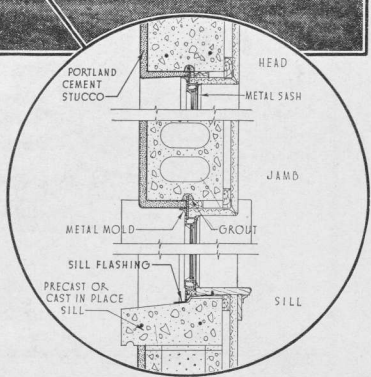
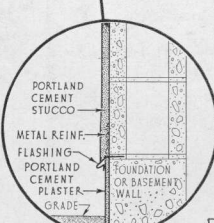
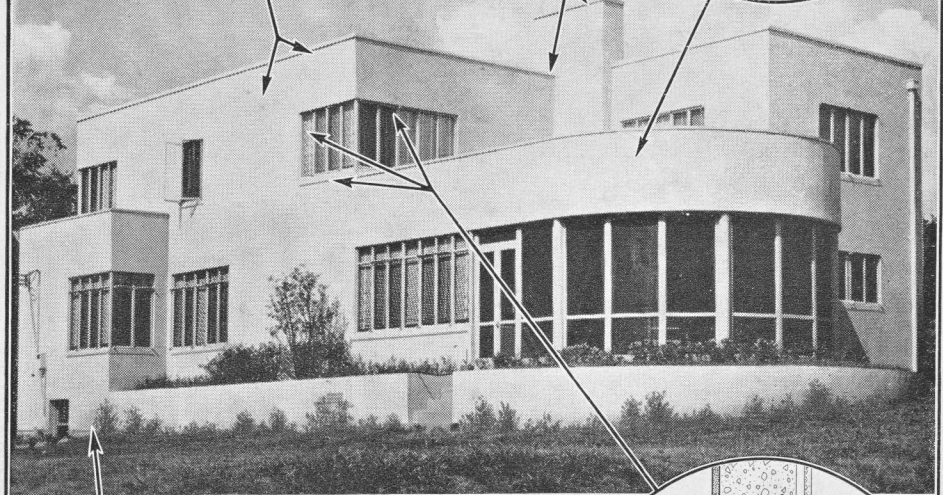
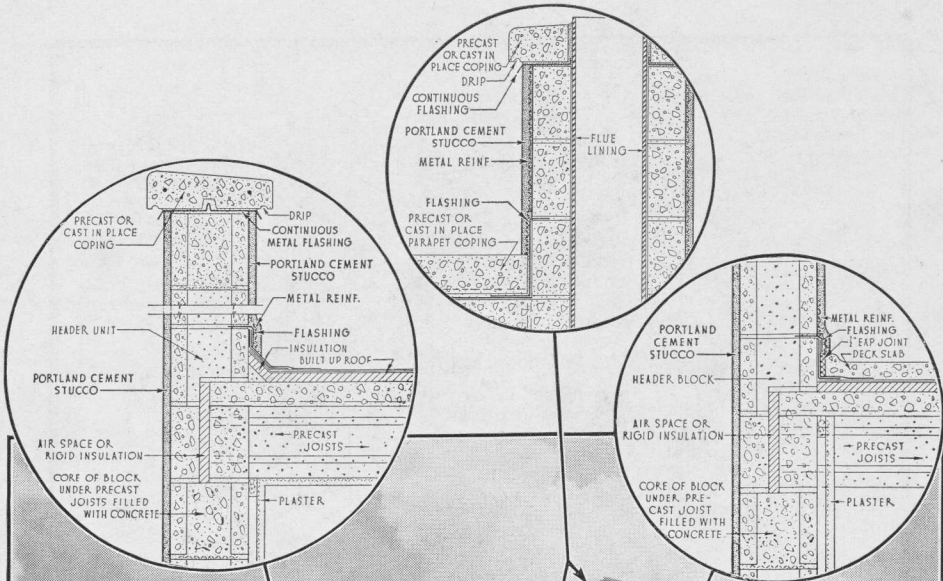
Cap applied after

SECTION "A-A"

Horizontal and sloped timbers to be flashed and reinforcement carried down over flashing

Waterproof building paper

FLASHING FOR STUCCO ON WOOD FRAME



FLASHING FOR STUCCO ON MASONRY CONSTRUCTION